National Institute of Environmental Health Sciences

Climate and on-farm risk factors associated with Giardia duodenalis cysts in storm runoff from California coastal dairies

Author(s): Miller WA, Lewis DJ, Lennox M, Pereira MGC, Tate KW, Conrad PA, Atwill ER
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Abstract:

Climatic factors and on-farm management practices were evaluated for their association with the concentrations (cyst/liter) and instantaneous loads (cysts/second) of Giardia duodenalis in storm-based runoff from dairy lots and other high-cattle-use areas on five coastal California farms over two storm seasons. Direct fluorescent antibody analysis was used to quantitate cysts in 350 storm runoff samples. G. duodenalis was detected on all five dairy farms, with fluxes of 1 to 14,000 cysts/liter observed in 16% of samples. Cysts were detected in 41% of runoff samples collected near cattle less than 2 months old, compared to 10% of runoff samples collected near cattle over 6 months old. Furthermore, the concentrations and instantaneous loads of cysts were ≥65 and ≥79 times greater, respectively, in runoff from sites housing young calves than in sites housing other age classes of animals. Factors associated with environmental loading of G. duodenalis included cattle age, cattle stocking number, and precipitation but not lot area, land slope, or cattle density. Vegetated buffer strips were found to significantly reduce waterborne cysts in storm runoff: each additional meter of vegetated buffer placed below high-cattle-use areas was associated with reductions in the concentration and instantaneous load of cysts by factors of 0.86 and 0.79 (-0.07 and -0.10 log10/m), respectively. Straw mulch, seed application, scraping of manure, and cattle exclusion did not significantly affect the concentration or load of G. duodenalis cysts. The study findings suggest that vegetated buffer strips, especially when placed near dairy calf areas, should help reduce the environmental loading of these fecal protozoa discharging from dairy farms.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Food/Water Quality, Food/Water Security, Precipitation

Food/Water Quality: Other Water Quality Issue

Water Quality (other): Turbidity

Food/Water Security: Livestock Productivity

Geographic Feature:

resource focuses on specific type of geography

Ocean/Coastal, Rural

Geographic Location: ☑

resource focuses on specific location

United States

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Foodborne/Waterborne Disease

Foodborne/Waterborne Disease: Cryptosporidiosis, E. coli, Giardiasis

Intervention: ☑

strategy to prepare for or reduce the impact of climate change on health

A focus of content

Resource Type: ☑

format or standard characteristic of resource

Policy/Opinion, Research Article

Timescale: ☑

time period studied

Time Scale Unspecified